

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-356353

(43)Date of publication of application : 26.12.2001

(51)Int.Cl.

G02F 1/1339

(21)Application number : 2001-125778

(71)Applicant : HITACHI INDUSTRIES CO LTD

(22)Date of filing :

30.03.1999

(72)Inventor : HACHIMAN SATOSHI

IMAIZUMI KIYOSHI

SAITO MASAYUKI

KAWASUMI YUKIHIRO

SANKAI HARUO

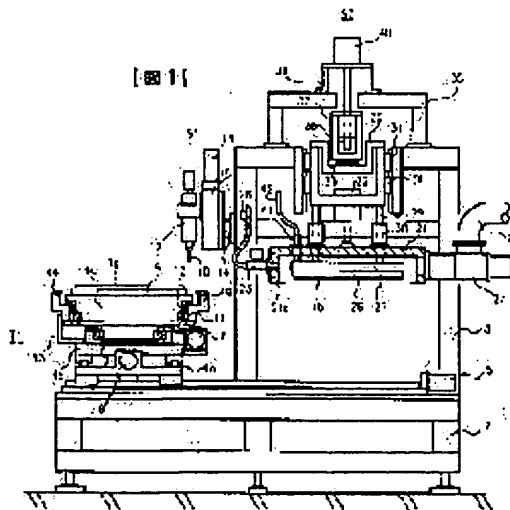
HIRAI AKIRA

(54) ASSEMBLY DEVICE FOR SUBSTRATE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an assembly device for substrates which bonds substrates to each other in a vacuum with high accuracy.

SOLUTION: This assembly device includes a moving mechanism for horizontally moving a table between the inside and outside of a vacuum chamber and has a means for drawing an adhesive to closed patterns on the other substrate held on the table positioned outside the vacuum chamber and a means for dropping liquid crystals into the closed patterns of the adhesive on the other substrate. The device has a means for holding the one substrate by suction attraction force to a pressurizing plate and a means for holding the same by electrostatic attraction force. The device has a means for accepting the one substrate falling from the pressurizing plate in a position to the extent of being slightly apart from the pressurizing plate when the suction attraction force does not act on the substrate any more in the process of progressing the pressure reduction in the vacuum chamber and a means for moving this accepting means to the pressurizing plate side. The



device is provided with a means for holding the one substrate to the pressurizing plate by acting the electrostatic attraction force thereon when there is the one substrate in this accepting means.

LEGAL STATUS

[Date of request for examination] 08.11.2001

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3411023

[Date of registration] 20.03.2003

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Hold the substrates stuck within a vacuum chamber, respectively, and this invention makes them counter, and relates to the assembly equipment of the substrate which narrows spacing and is stuck in a vacuum.

[0002]

[Description of the Prior Art] There is a process which closes liquid crystal to the space formed of lamination (the substrate after lamination is henceforth called a cel) and it with adhesives (henceforth a sealing compound) with spacing of about several micrometers which approached extremely in two glass substrates which attached a transparent electrode and thin film transistor array in manufacture of a liquid crystal display panel.

[0003] The approach proposed by JP,62-165622,A which liquid crystal is dropped on the substrate, arrange the substrate of another side on one substrate, an up-and-down substrate is made to approach in a vacuum, and while drawing to the pattern which closed the sealing compound so that an inlet might not be prepared sticks on the closure of this liquid crystal, There is an approach proposed by JP,10-26763,A which carries out pattern drawing of the sealing compound, and is poured in from the inlet of a sealing compound after the lamination of a substrate in a vacuum so that an inlet may be prepared on one substrate.

[0004]

[Problem(s) to be Solved by the Invention] With the above-mentioned conventional technique, each sticks both substrates in a vacuum irrespective of the pattern drawing order of a sealing compound. In a vacuum, suction adsorption of the substrate cannot be carried out by differential pressure with atmospheric air like [at the time of an ambient condition].

[0005] If the edge of the substrate (it is hereafter called an upper substrate.) located in the bottom is held mechanically, the center section of a substrate will bend, and the deflection is large as the latest substrate enlargement and a sheet metal-ized inclination become strong.

[0006] Since it positions using the alignment mark prepared in the periphery edge of vertical each substrate, spacing of the edges of both substrates cannot do flare alignment, so that a deflection is large.

[0007] Furthermore, since the center section of an upper substrate contacts a lower substrate (it is hereafter called a bottom substrate.) ahead of the periphery section by the deflection of an upper substrate, in order to make substrate spacing regularity, the spacer currently sprinkled between substrates will move, and the orientation film currently formed on the substrate will be damaged.

[0008] Since the up-and-down substrate stuck in fact is the same size, it is in the condition that maintenance cost can hardly be taken.

[0009] So, the purpose of this invention has substrate size in offering enlargement and the assembly equipment of the substrate which can stick comparable substrates with high precision in a vacuum even if it sheet-metal-izes.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, while sticks this invention on the inferior surface of tongue of a pressure plate in which it is located above [in a vacuum chamber], and it holds a substrate. In the assembly equipment of the substrate which hold the substrate of another side to stick on the table located down [in a vacuum chamber], and both substrates are made to counter, narrows spacing of both substrates in a vacuum with the adhesives formed in one of substrates, and sticks substrates While providing the migration device to which a table is moved horizontally between the inside and outside of a vacuum chamber A means to draw to the pattern which closed adhesives to the substrate of another side held on the table located out of the vacuum chamber, A means by which liquid crystal is dropped in the pattern which the adhesives on the substrate of this another side closed, A means to make one substrate hold by suction adsorption power to a preparation and said pressure plate, Establish the means made to hold by electrostatic adsorption power, suction adsorption power stops working in the process in which reduced pressure in a vacuum chamber is advanced, while falls from a pressure plate, and a substrate is caught and caught in the location of extent slightly distant from the pressure plate. A means, It had a means to move this carrier stop means to a pressure plate side, and when [said] it caught and one substrate was in a means, a means to have made electrostatic adsorption power act and to make one substrate hold to a pressure plate was established.

[0011]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained based on drawing.

[0012] In drawing 1 thru/or drawing 3 , the substrate assembly equipment of this invention consists of the liquid crystal dropping section S1 and the substrate pasting section S2, and both this part adjoins on a stand 2, and is arranged. The frame 3 which supports the substrate pasting section S2 is above a stand 2. Moreover, the top face of a stand 2 is equipped with the XYtheta stage T1. X stage 4a can come now and go between the X shaft orientations S1 on either side, i.e., the liquid crystal dropping section, and the substrate pasting section S2 on a drawing with a drive motor 5. Y stage 4b is on X stage 4a, and can come and go now to Y shaft orientations which intersect perpendicularly with X stage with a drive motor 6. theta stage 4c is on Y stage 4b, it is pivotable horizontally to Y stage 4b through the rotation bearing 7 with the drive motor 8, and the table 9 which carries a substrate on theta stage 4c is fixed. Moreover, the bottom chamber 10 is being fixed to Y stage 4b on the plate 13. To the bottom chamber 10, through the rotation bearing 11 and the vacuum seal 12, theta stage 4c is attached in rotation freedom, and by making Shaft A into the center of rotation, even if theta stage 4c rotates, it makes the bottom chamber 10 the structure which it is hung and is not rotated.

[0013] The liquid crystal dropping section S1 consists of motors 16 which drive the Z-axis stage 15 for carrying out vertical migration of the dispenser 17 and this which were supported with the bracket 14 projected from the frame 3 to drop the liquid crystal agent of the amount of requests at bottom substrate 1a held at the table 9, and it. It moves in X and the direction of Y to the nozzle 18 of the dispenser 17 which trickles a liquid crystal agent on the XYtheta stage T1 which carried out maintenance loading of the bottom substrate 1a on the table 9. Thereby, the liquid crystal agent of the amount of requests is dropped at the part of the arbitration on bottom substrate 1a.

[0014] The XYtheta stage T1 which carried out loading maintenance of the bottom substrate 1 after liquid crystal dropping a is moved to the lower part of the substrate pasting section S2 with a drive motor 5.

[0015] In the substrate pasting section S2, the electrostatic fixing disc 28 of the upper chamber 21 and its interior has structure which can move up and down independently, respectively. That is, the upper chamber 21 has the housing 30 having a linear bush and a vacuum seal, and moves to up-and-down Z shaft orientations in the cylinder 22 fixed to the frame 2 by considering a shaft 29 as a guide.

[0016] If the XYtheta stage T1 is moving to the substrate pasting section S2 and the upper chamber 21 descends, the flange of the upper chamber 21 contacts and is united in O ring 44 arranged around the bottom chamber 10, and it will be in the condition of functioning as a vacuum chamber at this time.

[0017] The amount of crushing of O ring 44 adjusts the downward halt location of the upper chamber 21, and sets it as extent from which the inside of a vacuum chamber can be maintained at a vacuum, and

the maximum elasticity is acquired.

[0018] Since the vacuum seal which can move up and down is built in without causing vacuum leakage to a shaft 29 even if housing 30 forms and deforms the upper chamber 21 for the bottom chamber 10 and a vacuum chamber Deformation of a vacuum chamber can absorb the force given to a shaft 29. It can prevent mostly, and deformation of the pressure plate 27 which was fixed to the shaft 29 and held the electrostatic fixing disc 28 maintains parallel in upper substrate 1b held at the electrostatic fixing disc 28 so that it might mention later, and bottom substrate 1a held at the table 9, and the lamination of it becomes possible.

[0019] It connects with the source of a vacuum which illustrates 23 by the vacuum bulb and is not illustrating 24 with a piping hose, and these are used, when decompressing a vacuum chamber and making it a vacuum. Moreover, 25 is a gas purge valve and 26 is a gas tube, it connects with pressure sources, such as N₂ and a clean dried air, and these are used when returning a vacuum chamber to atmospheric pressure.

[0020] Although adhesion maintenance of the upper substrate 1b is carried out on the inferior surface of tongue of the electrostatic fixing disc 28, upper substrate 1b is held by suction adsorption under atmospheric air at the electrostatic fixing disc 28. That is, 41 is a joint for suction adsorption, 42 is a suction tube, it connects with the source of a vacuum which is not illustrated, and two or more suction holes connected with it are prepared in the 28th page of an electrostatic fixing disc.

[0021] In addition, when the surroundings are atmospheric air, electrostatic adsorption may be used together, and when electrostatic adsorption power is large, it is good also as unnecessary in suction adsorption.

[0022] The electrostatic fixing disc 28 is attached in the pressure plate 27 supported with the shaft 29, and the shaft 29 is being fixed to housing 31 and 32. Housing 31 is attached in the linear guide 34 to a frame 2, and the electrostatic fixing disc 28 has structure which can move up and down. The motor 40 fixed to the bracket 38 on a frame 2 and the connected frame 35 performs the vertical drive. Transfer of a drive is performed with a ball thread 36 and the nut housing 37. The nut housing 37 is connected with housing 32 through a load cell 33, and operates by the electrostatic fixing disc 28 of the lower part, and one.

[0023] Therefore, a shaft 29 descends by the motor 40, the electrostatic fixing disc 28 holding upper substrate 1b descends, upper substrate 1b sticks with bottom substrate 1 on table 9 a, and it has the structure where welding pressure can be given. In this case, a load cell 33 works as a welding-pressure sensor, it is controlling a motor 40 based on the fed-back signal serially, and it is possible to give desired welding pressure to the vertical substrates 1a and 1b.

[0024] Although immobilization of positioning by forcing by the horizontal direction with the roller 82 with ** is enough for the positioning member 81 prepared in the table 9 as shown in drawing 2 since bottom substrate 1a is loading of the gravity direction In the case of minute positioning just before sticking Since bottom substrate 1a may shift under the effect to which upper substrate 1b contacted the sealing compound on bottom substrate 1a, and the liquid crystal agent, or the air which has entered between bottom substrate 1a and a table 9 in the process which the inside of that it may be raised or a vacuum chamber is decompressed, and becomes a vacuum may escape and bottom substrate 1a may dance and shift The function of electrostatic adsorption may be given also to a table 9. And if the pin which can move to vertical Z shaft orientations is prepared and grounded on the table 9, cel removal from electrification prevention and the table 9 of the cel after substrate lamination can be performed easily.

[0025] 60 shown in drawing 2 is the receiving claw caught in the location under small of the electrostatic fixing disc 28, when the electrostatic fixing disc 28 is carrying out suction adsorption, a vacuum chamber is decompressed, suction adsorption power disappears and upper substrate 1b falls, and it is supported by the form hung with the shaft 59 which is in the location of two vertical angles of upper substrate 1b, and was extended caudad. As shown in drawing 3, the vacuum seal of the shaft 59 is carried out through the housing 58 of the upper chamber 21, and it has come to be specifically able to perform rotation and vertical migration. Namely, it not only can move a shaft 59 further up and down,

but with vertical migration of a shaft 29, it can rotate it now independently with the rotation actuator 61 with the rise-and-fall actuator 62 fixed to the bracket 63 prepared in the shaft 29.

[0026] Next, the electrostatic fixing disc 28 which adsorbs a substrate is explained.

[0027] The electrostatic fixing disc 28 is a plate of an insulating material, it has two rectangular crevices, the plate electrode built in each crevice is covered with a dielectric, and the principal plane of the dielectric is the same flat surface as the inferior surface of tongue of the electrostatic fixing disc 28. Each embedded plate electrode is connected to the DC power supply of positive/negative through the proper switch, respectively.

[0028] Therefore, if a forward or negative electrical potential difference is impressed to each plate electrode, induction of negative or the positive charge will be carried out to the principal plane of the dielectric which is the same flat surface as the inferior surface of tongue of the electrostatic fixing disc 28, and electrostatic adsorption of the upper substrate 1b will be carried out by the Coulomb force generated between the transparent electrode film of upper substrate 1b with these charges. A like pole is sufficient as the electrical potential difference impressed to each plate electrode, and bipolar [different, respectively] is sufficient as it.

[0029] Next, the process which sticks a substrate with this substrate assembly equipment is explained.

[0030] First, the fixture holding upper substrate 1b is carried in a table 9, and the substrate pasting section S2 is made to move the XYtheta stage T1 to it with a drive motor 5. Then, since a pressure plate 27 and the electrostatic fixing disc 28 are dropped through a shaft 29 by the motor 40 and suction adsorption of the upper substrate 1b on a table 9 is carried out, it is made to go up by the motor 40, and upper substrate 1b is made into a standby condition.

[0031] It returns to the liquid crystal dropping section S1, the fixture which became empty is removed, bottom substrate 1a is carried on a table 9, and as shown in drawing 2, fixed maintenance of the XYtheta stage T1 is carried out in a request location.

[0032] Although not shown in drawing 1, there is a dispenser which carries out the regurgitation of the sealing compound to a frame 3, and if a sealing compound is made to breathe out, moving bottom substrate 1a to XY shaft orientations by each motors 5 and 6 of the XYtheta stage T1, a sealing compound can be drawn by the pattern closed on bottom substrate 1a (closing). Then, a liquid crystal agent is dropped on bottom substrate 1a from a dispenser 17. In this case, a sealing compound serves as a dam and the dropped liquid crystal agent is not spilt out.

[0033] Next, move the XYtheta stage T1 to the substrate pasting section S2, drop the upper chamber 21 in a cylinder 22, the flange 21a is made to contact O ring 44, and the bottom chamber 10 and a vacuum chamber are made to form. And the vacuum bulb 23 is opened wide and the inside of a vacuum chamber is decompressed. Since suction adsorption has been carried out by upper substrate 1b at the electrostatic fixing disc 28 at this time, if reduced pressure progresses and vacuates, the suction adsorption power which was acting on upper substrate 1b will disappear and go, and upper substrate 1b will fall by self-weight. This is caught with a receiving claw 60, as shown in drawing 2, and as shown in drawing 3, it holds in the location under small of the electrostatic fixing disc 28.

[0034] When the inside of a vacuum chamber becomes a vacuum enough, an electrical potential difference is impressed to the electrostatic fixing disc 28, and suction maintenance of the upper substrate 1b on a receiving claw 60 is carried out by Coulomb force at the electrostatic fixing disc 28. In this case, since it is already a vacuum, when that air escapes so that air may not remain between the electrostatic fixing disc 28 and upper substrate 1b, upper substrate 1b does not dance. A more important thing is that upper substrate 1b has stuck to the electrostatic fixing disc 28, without making air intervene. Therefore, discharge is not generated with an induction charge.

[0035] Air expands, when discharge is produced with air left, upper substrate 1b may be made to exfoliate from the electrostatic fixing disc 28, or thin glass upper substrate 1b may be destroyed, but since air does not exist according to this operation gestalt, such abnormality accident does not occur.

[0036] Then, as a shaft 59 is dropped with the rise-and-fall actuator 62, next a shaft 59 is rotated with the rotation actuator 61 and a receiving claw 60 does not become the obstacle of the lamination of vertical both substrates, since, dropping a pressure plate 27 by the motor 40, and measuring welding

pressure with a load cell 33, a motor 40 is controlled and vertical both the substrates 1a and 1b are stuck on request spacing.

[0037] In this case, since upper substrate 1b is stuck to the electrostatic fixing disc 28 and the center section does not droop, it does not have a bad influence on the spacer in a liquid crystal agent, or the alignment of substrates does not become impossible. Incidentally, alignment reads the alignment mark prepared in vertical each substrates 1a and 1b with the image recognition camera in the inspection hole prepared in the upper chamber 21 which omitted illustration, measures a location by the image processing, makes each stage 4a thru/or 4c of the XYtheta stage T1 move slightly, and performs highly precise alignment.

[0038] After lamination is completed, the vacuum bulb 23 is opened for the gas purge valve 25 in total, N₂ and a clean dried air are supplied in a vacuum chamber, after returning to an atmospheric pressure, the gas purge valve 25 is closed, the upper chamber 21 is raised in a cylinder 22, the XYtheta stage T1 is returned to the liquid crystal dropping section S1, a cel is removed from a table 9, and it prepares for the following lamination. Since the cel after pasting may be charged, after making the grounded antistatic bar contact or carrying out electric discharge processing of blowing and applying an ion wind here, it is good to remove a cel from a table 9. As for the cel removed from the table 9, a sealing compound is hardened with down-stream UV light irradiation device, heating apparatus, etc.

[0039] With the above operation gestalt, since a sealing compound is breathed out, liquid crystal is dropped and it shifts to lamination immediately, the production yield can be improved that a substrate is hard to receive dust. Moreover, the XYtheta stage T1 can be used for conveyance into the vacuum chamber of upper substrate 1b, and the miniaturization of equipment is attained.

[0040] This invention may be carried out not only in the operation gestalt explained above but as follows.

[0041] (1) The supply to the electrostatic fixing disc 28 of upper substrate 1b carries upper substrate 1b on two or more of the receiving claws, when two or more receiving claws (thing equivalent to the receiving claw 60 of drawing 2) which can be expanded and contracted in the vertical direction are formed in the XYtheta stage T1 and the XYtheta stage T1 is in the liquid crystal dropping section S1, and you may make it move the XYtheta stage T1 to the substrate pasting section S2.

[0042] (2) Moreover, suction adsorption may be carried out to the direct electrostatic fixing disc 28 from a robot hand.

[0043] (3) You may make it catch upper substrate 1b which falls with the receiving claw formed in the XYtheta stage T1 explained above (1) in case reduced pressure progresses.

[0044] (4) With the receiving claw furthermore formed in the XYtheta stage T1 explained by the receiving claw 60 of drawing 2 , or the above (1), before upper substrate 1b falls, upper substrate 1b is forced on the electrostatic fixing disc 28, reduced pressure may be advanced to the electrostatic fixing disc 28 from the condition by which suction adsorption was carried out, and you may change to electrostatic adsorption. In this case, the air between upper substrate 1b and the electrostatic fixing disc 28 can be vacuated with reduced pressure by making it not say that upper substrate 1b has stuck to the electrostatic fixing disc 28 physically.

[0045] (5) Upper substrate 1b is held in the slightly distant location from the electrostatic fixing disc 28 with the receiving claw formed in the XYtheta stage T1 explained by the receiving claw 60 of drawing 2 , or the above (1) further again, and electrostatic adsorption may be performed while advancing reduced pressure without carrying out suction adsorption.

[0046] (6) Moreover, although two corners (two corners which constitute a vertical angle) of upper substrate 1b are held with the receiving claw 60 in drawing 2 , four corners (four corners) of upper substrate 1b may be held, or you may make it hold with four sides of upper substrate 1b, two sides of a longitudinal direction, or a means with the cross direction proper two sides.

[0047]

[Effect of the Invention] As explained above, even if it enlarges and substrate size sheet-metal-izes, according to this invention, comparable substrates can be stuck with high precision in a vacuum.

[Translation done.]